Making Molecular Motors Work

2 PhD student positions; start date between November 1, 2005 and March 1, 2006.

In the Van 't Hoff Institute for Molecular Sciences two PhD student positions are available for research projects within the NanoNed program *Chemistry and Physics of Individual Molecules*. For project 1 the required background is an MSc. degree in ORGANIC CHEMISTRY, for project 2 an MSc. in PHYSICS or PHYSICAL CHEMISTRY.

Project 1. Development of light-driven translational molecular motors
This project comprises the design and synthesis of novel motor molecules, which should be able to carry loads over distances of the order of 10 nm. The photochemical tools that will be used to induce the motion in a controlled way are developed in collaboration with another PhD student, already appointed. Another aspect of the project will be the chemical modification of surfaces and the attachment of molecules to them.
Because the first challenge is the design and synthesis of organic molecules (rotaxane architecture) *proven skill in organic synthesis* is a requirement for this project. Interest in photo physical experiments and surface chemistry is also important.

Project 2. Moving molecules in nano-landscapes
For motor molecules to be able to do useful work, their motion has to be controlled. A popular approach, which we will also adopt, is to attach molecules to surfaces. Among the convenient surfaces to use are metals and semiconductors, which, however, influence the photo physical behavior of attached molecules. Quenching of excited states by metals is a commonly observed effect, but recent theoretical and experimental work has shown that enhancement of radiative transitions is also possible. Properly designed nanostructures can "guide" the electromagnetic field on length scales which are smaller than the wavelength. Our goal will be to exploit this to control the motion in light-activated motor molecules.
The project will comprise the study of synthetic motor molecules (already available in our laboratory, or the result of project 1 above) near metal or semiconductor surfaces and near nanoparticles, primarily using confocal fluorescence microscopy combined with single molecule detection techniques. For this project a good understanding of optics is important, as well as experience with instrumental work and data analysis.

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References
NanoNed: http://www.nanoned.nl/
Van 't Hoff Institute for Molecular Sciences: http://www.science.uva.nl/hims/
Molecular Photonics group: http://www.science.uva.nl/research/molphot/
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